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SEPTEMBER
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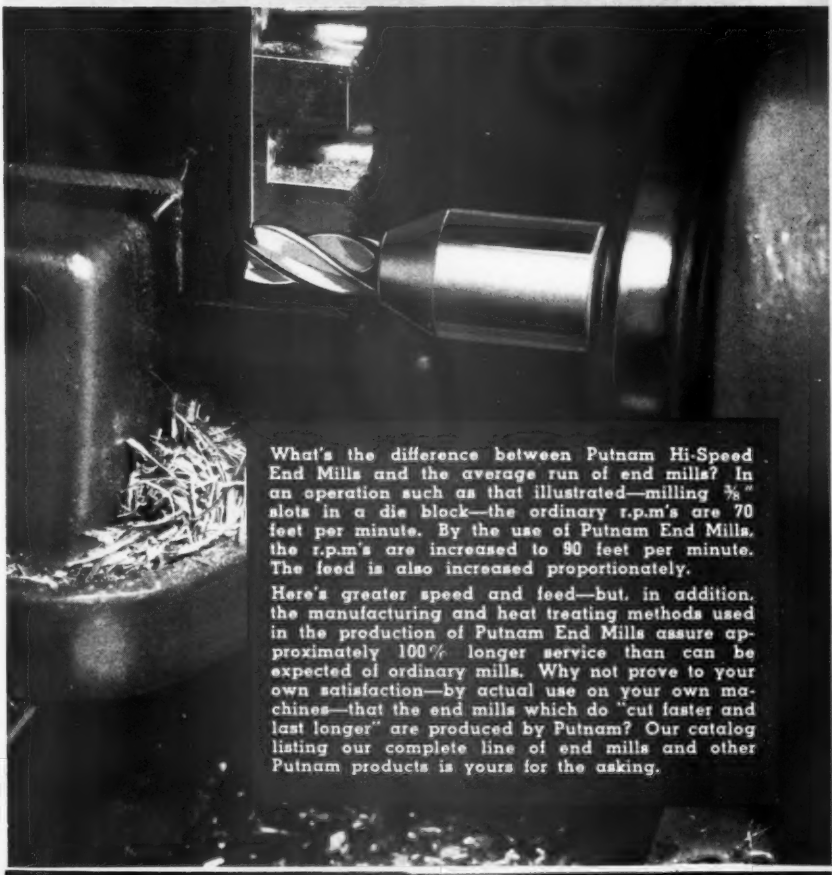

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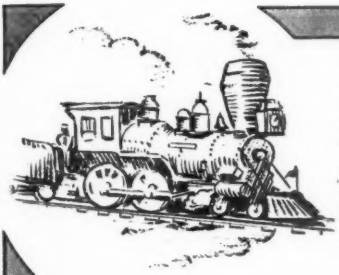

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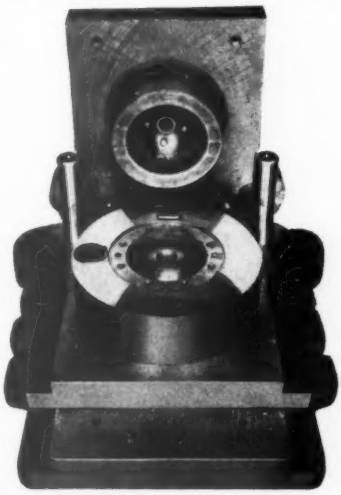

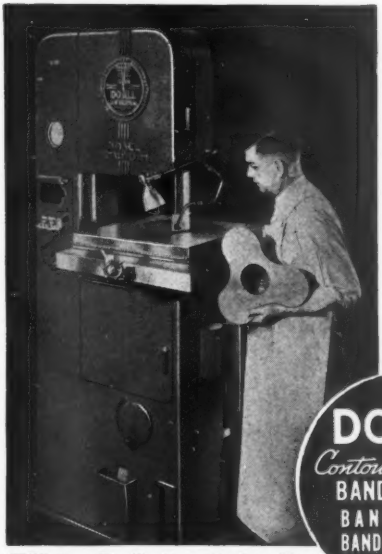

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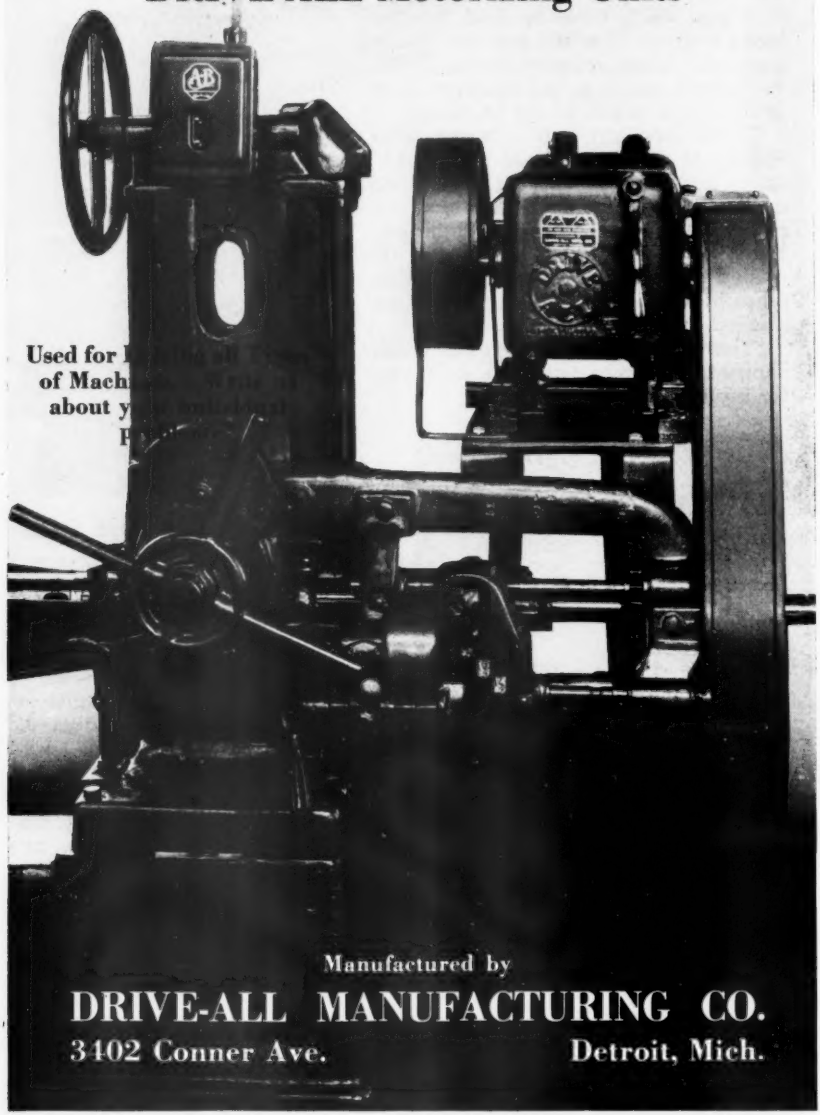

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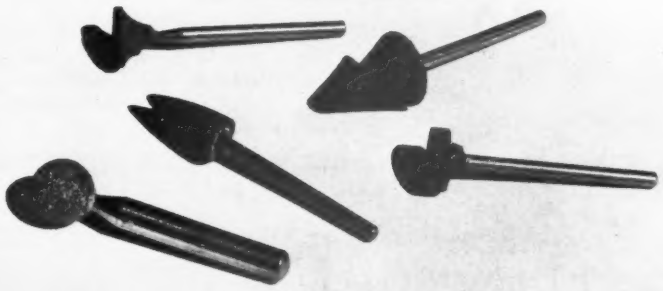

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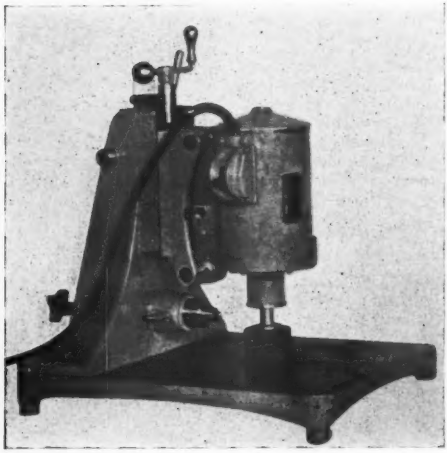

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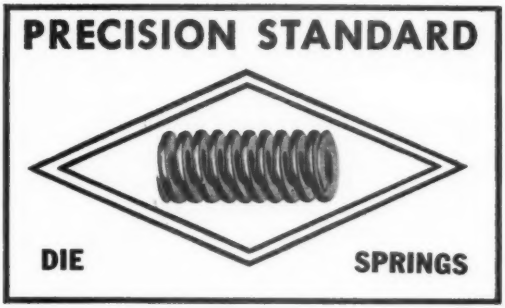


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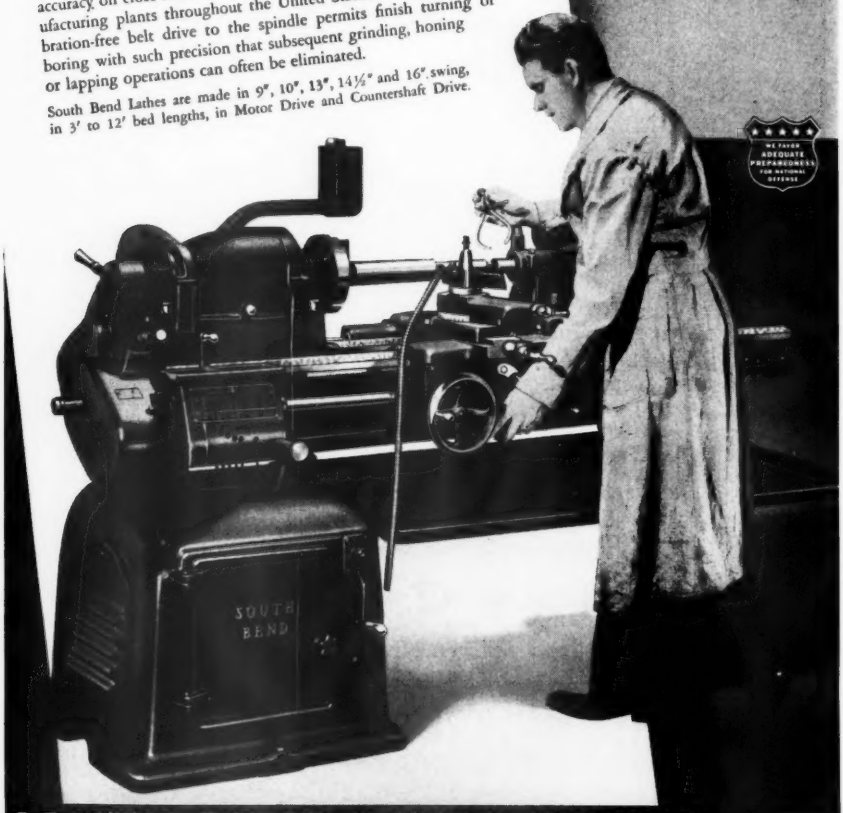


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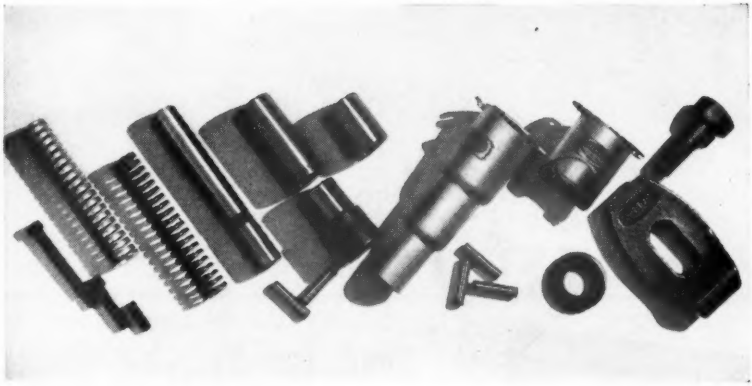

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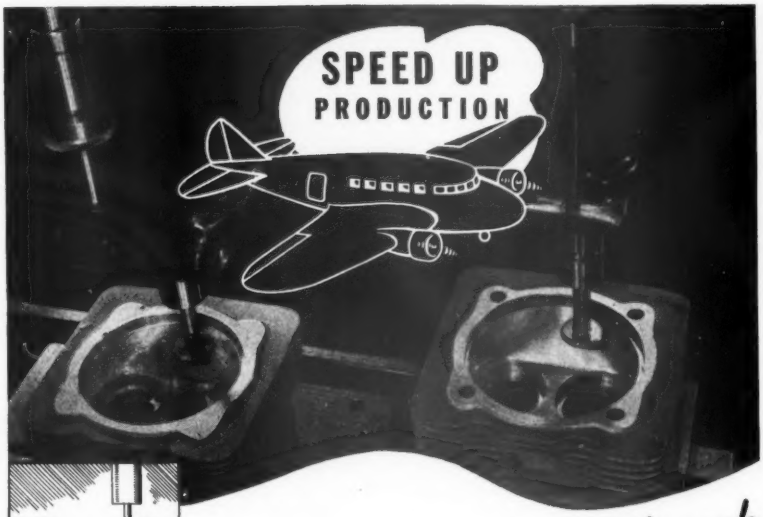


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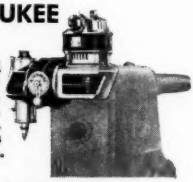

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TOOL · DIE · MACHINE PROGRESS
*The National Tool and Die Journal*
SEPTEMBER, 1940 Vol. 6, No. 6

# PLASTIC MOLD DESIGNING

By GORDON B. THAYER

Plastic Design Engineer
General Industries Company

*Article VII of a Series*

## *The Design of a Stripper-Plate Injection Mold*

A STRIPPER-PLATE mold is one in which the molded casting is ejected by means of a movable plate which "molds" the extreme rear face of the casting. The term "mold" is often used to indicate such areas of a mold part which form the surface of a casting. When a stripper-plate mold is in the closed position, ready to receive the charge from the injection cylinder, the stripper-plate has been pushed back to form the rear, or closing wall of the mold cavity. After injection of material and cooling of the casting, the mold is opened, and the ejector mechanism pushes the stripper-plate to the forward limit of travel. This operation strips the casting from the cores.

If a plain or "flat-back" casting is being molded, it will drop out of the mold automatically at the end of the ejector stroke. Sometimes, however, a stripper-plate may be recessed to form a short projection on the molded casting, smaller in area than the portion molded in the cavity block. Such a mold may or may not be entirely automatic in operation. If the recess in the stripper-plate is very short, or has plenty of draft, the casting may fall out of its own accord. Or, if it does not fall out, but is held loosely, it may be dislodged by a mechanical wiping arm. Such an arm swings across the face of the mold, under the control of a cam, and strikes the sprue slug, causing the casting to fall away from the mold. Instead of using the cam-operated wiper, the operator may use a wooden stick. The casting may be held too firmly in the stripper-plate to be dislodged by a wiping arm, in which case it must be removed from the mold manually. Since this requires the operator to put his hand in the mold, it is dangerous. A manual operation also increases the length of the molding cycle.

The cigarette box Fig. 12 is made in two parts. The cover is a plain-back piece, while the box is cut back half the wall thickness to enter it. It may be seen from the foregoing discussion that the cover can be made easily in a stripper-plate mold, which can be fully automatic in operation. The box is an example of a piece which might be made in the same type of mold with the telescoping portion recessed in the stripper-plate. One reason for employing this design is that the thin wall section (.045") happens to occur at the point where ejector pins would have to be placed for a conventional automatic design. The pins would be rather thin, and subject to breakage. Also, objectionable pin marks would appear.

It is to be noted that the box is dimensioned from the inside, where the contents must fit. This gives the designer and builder a chance to vary the wall section as required to obtain draft and allows some leeway in the dimension of the hobbed cavity blocks. On a deep draw especially, it is not easy to control the size of a hobbed impression as the metal is compressed cold and expands unpredictably on carburizing and hardening as the heat relieves the cold-working stresses. The product designer can do much for the mold designer by dimensioning exactly to show what he wants.

### Mold for the Box Cover

A mold for the box cover is shown in Fig. 13. Two views are given, one a sectional elevation, and the other a view facing the ejection half. It is preferred to show the ejection half as more detail may be seen. The parting line comes between the stripper-plate (detail 19) and the cavity retainer plate (detail 8). The cavities are arranged in rows for the closest possible spacing of the rectangular blocks.

The mold is of the stripper-plate type, and consists essentially of cavities and cores, retainer plates, backing plates, stripper plate, ejection mechanism, adaptor plates, and the system of sprue, runners and gates for introducing the material into the cavities.

### The Cavities and Cores

Six cavity blocks (detail 30) are hobbed from soft mold steel shaped to size, carburized, hardened, ground and polished. The retaining shoulder at the rear of the blocks is shown all around, but if space is not available they may be only on the sides or ends. Two retaining flanges rather than four saves some shaping time. The core blocks (detail 28) are shaped from alloy mold steel bar stock, and are hardened, ground and polished. Polishing of cavities and cores is confined to molding portions and grinding to fitting portions. Outside dimensions are not critical, but corresponding dimensions should be equal for all units. The rectangular shape of the blocks insures proper alignment without doweling to prevent rotation out of register with the gate. The gate is ground in the cavity block portion.

### Retainer Plates

The cavity retainer plate (detail 8) is made of alloy mold steel left soft. Water lines are drilled in this plate, inlet and outlet are shown at details 12, 13. Four guide pin bushings (detail 29) are mounted in this plate. Some mold builders prefer to have the bushings pressed in as shown rather than retained by a flange at the rear. The bushings are hardened. The retainer plate is ground to the same thickness as the cavity blocks and is relieved slightly outside the area which closes off the cavities and runners.

The core retainer plate (detail 18) is made of the same material as the other retainer. The guide pins (detail 20) are pressed into this plate.

The cavity blocks are backed by the adaptor plate (detail 10) and the core blocks by the backing plate (detail 17). Both plates are made of alloy mold steel, hardened to prevent sinking of cavities and cores. Clearance holes are provided in the backing plate for the retainer screws (detail 6) and tapped holes for the assembly screws (detail 26). Clearance holes are provided for stripper bolts and ejector pins.

### Stripper-Plate

The stripper-plate (detail 19) is made of alloy mold steel left soft. It must be carefully fitted to the cores and be free to slide. The runners (detail 23) are cut in this plate. The stripper rides on the guide pins which extend beyond the plate even at the extreme forward limit of travel. Two stripper bolts (detail 7) are shown in the assembly. They may or may not be used. If the stripper-plate is heavy and slides freely, it may slide off the guide pins and be damaged in falling. Practically it is not possible to make the stripper fit in the two possible positions to which it may be turned. This is because the cores and guide pins cannot be located accurately enough. By employing stripper bolts, proper assembly is assured with no danger of the press operator getting the plate turned around because he cannot get it off to do so. The various plates are match-marked, but still operators get the stripper on wrong occasionally. Disadvantages of stripper bolts are that the stripper cannot be removed without disassembling the whole mold, and the

*(Continued on Page 41)*

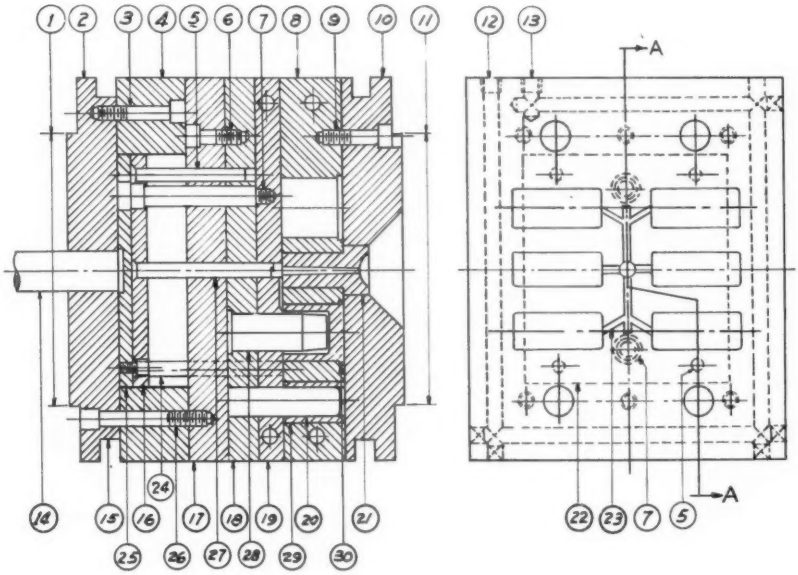
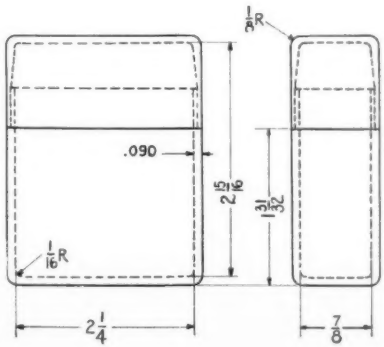



**Fig. 12 (below) shows side and end elevation views of cigarette box. The plain-back piece cover is the product of the mold illustrated. Fig. 13 (above), two views of the box cover mold—one facing the ejection half—the other a sectional elevation. The compact six cavity stripper-plate design is adapted to short cycle high production runs.**




### Principal Parts

1. Mounting boss—ejection half
2. Adaptor plate—ejection half
4. Ejector box spacer
5. Ejector pin
7. Stripper bolt
8. Cavity retainer plate
10. Adaptor plate—injection half
11. Mounting boss—injection half
12. Water inlet
13. Water outlet
14. Ejector rod
15. Clamping slot
16. Pin retainer plate
17. Backing plate
18. Core retainer plate
19. Stripper plate
20. Guide pin
21. Sprue bushing
22. Outline of ejector box
23. Runner
24. Ejector return pin
25. Pin assembly plate
27. Sprue lock pin
28. Core block
29. Guide pin bushing
30. Cavity block

# The Evolution of the Manufacturing Machine

By GEORGE L. McCULLOCH
Enterprise Machine Parts Corporation

**The single-purpose machine is a development of comparatively recent years. In this article the author sketches this development from the machine's beginning as an adapted machine tool to its present state as a specialized Manufacturing Machine, specifically designed from the ground up and built to embody all of the features which have made it such an outstanding contribution to mass production. The author sets forth convincingly both the tangible and intangible values which made the single-purpose Manufacturing Machine so important as a factor in the broader employment of both semi-skilled and unskilled labor. The Manufacturing Machine will again demonstrate its importance in the production schedules which the National Defense Program will make necessary.**

***—The Editor***

RARE is the major change that occurs full-bloom. This is axiomatic in mathematics. Napier's Logarithms are unchanged since the day of their invention. Special arrangements of Log Tables for specific applications have made them easier to use. More places to the right of the decimal have increased their accuracy of application. But there has been no change—it was all there in the beginning. And so with machine tools — applied mechanics in metal—there has been no *major* change. We still have lathes, milling machines and grinders. Each year improved metals, easier controls, faster operating cycles, carbides and similar advances have increased stability and ruggedness, flexibility, accuracy, ease and safety of operation and the production possibilities of such machines. Yet they remain tool room machines requiring years of training and skill to get the best results from them. They are not Manufacturing Machines.

Given a fixed set of conditions, engineers and master mechanics struggle faithfully to ADD TO these machines one or more features that will enable them to perform their functions faster, easier, more economically. Such additions, as a fixture for example, may become so important that the basic machine is merely an accessory. Within the limits of engineering ingenuity and the fixed design of such a basic machine, it has been possible to develop a new single-purpose machine that will produce the required volume and accuracy and with a minimum of training required of the operator. But designers have always been held within the limits of the

type of machine tool which they are adapting.

### Trend Toward Single-Purpose Machines

Several years ago there began a trend toward single-purpose machines. These were no longer mills, drills or the other so-called standard tools; they were machines intended to do specific jobs more efficiently, more economically. They might do any one or several of the conventional operations. Such machines were hybrids—part this and part that—and there was no name for these structures that could mill, drill, turn, press in bushings, etc. "What did we call them?" "Special Machines, designed and built in our own shop."

So we had a Special Machine composed of standard machine elements, with fixtures added, doing a definite manufacturing job. Yet it was not wholly new. All that was new was the arrangement of the elements—they were easier to work with, more accurate to use. Nevertheless, skill and labor had produced a new type of MANUFACTURING MACHINE. The satisfaction of building it, the joy of watching it work successfully and the report of the accounting department were the rewards. Designers and builders hardly realized that a new manufacturing era was being born and that they were assisting with its birth.

### Manufacturing Machines are a Logical Development

It is more logical to design and build a complete Manufacturing Machine than it is to build a fixture to convert a standard machine. A fixture limits the standard machine to a definite cycle—the machine can be no greater than the fixture. Economy, competition and the lack of training of our youths justify the Manufacturing Machine with its greater production capacity, its resultant lower product cost and the opportunity to employ unskilled labor.

The first step in producing a Manufacturing Machine is a print showing the part to be machined and a schedule showing the probable requirements. With these meager facts, it is possible to complete the necessary detail subsequent to a mutual agreement and an order to build.

The toughest part of building Manufacturing Machines is that more than half of their benefits are given away and still they must show a profit to the builder. It is not at all difficult to sell a machine whose operating efficiency results in savings greater than are possible by any other method.

Manufacturing Machines are designed completely, to do a definite job. They are not part fixture and part machine. The correct feeds and speeds are built in. Various functions are interlocked. Operating effort is held to a minimum. The required degree of accuracy is built into the machine, the design assuring that this accuracy will remain for long periods of time. Every possible element that might cause error is removed. The result is a smooth running unit designed and built to do the job economically, accurately and without skilled help.

### Intangible Benefits Also

There are additional benefits which a cost department may not be able to tabulate into non-argumentative totals. However, every operating executive knows they exist. Sickness, an accident, insubordination never threatens an entire production line. There is no long, costly training of an operator in an emergency. A foreman merely instructs a new operator—places the part—tightens a clamp—pushes a button. He stays with the new operator an hour or two and keeps alert to the machine during the rest of the day—tomorrow it's routine. There has been only a small production drop. Of course, we never get to build a machine for these reasons—we have to show a dollars and cents saving in product cost over the most ingenious methods devised previously. Nevertheless, you do get these valuable intangibles with every Manufacturing Machine and you get them practically without cost.

These assurances alone should constitute sufficient reasons for buying single-purpose Manufacturing Machines and when there are added the savings in production costs which such machines effect in comparison with so-called adapted equipment, there is usually no argument about the desirability of providing the necessary appropriation.

*Fig. 1—This Head Massager, produced by Black & Decker Co. on a G & M die casting machine, is an example of efficient, modern die casting design and production.*

# Tapers and Tolerances in Die Casting

*By Charles G. Siefert*

*Drawings by A. Holder*

LIKE all really great ideas, die casting is extremely simple in its fundamental principle. The principle is so well known that we need not go into it in this short article. As with all utilizations of a simple principle, the complications are in the applications.

Every one of us has engaged in the absorbingly relaxing job of sprinkling the lawn. If you recall the result when the stream of waters hits some solid object shortly after it leaves the nozzle, you can get some idea of what happens when molten metals at temperatures ranging from 780 degrees to 1800 degrees enter the impression in the mold at a speed of between 6000 and 10,000 feet per minute. To control this turbulance and, within a fraction of a second, to change this chaos of speed and heat into something that conforms to the exacting specifications of mass production is the die caster's job.

The metallurgist is continually striving to improve the materials which will stand the strain of shrinkage around a solid core and hold to tolerances determined by the necessities of interchangeability. It is the metallurgist's job also to create and improve steels which will take the terrific punishment dealt out by heat, to stand up to the physical impact of highly agitated currents of metal and to pressures ranging from 500 to 30,000 pounds per square inch.

Great improvements in metals, steels and machines have been made in the last few years. These developments have made it possible for the die caster to tackle problems which only a few years ago would have seemed impossible. As the number of practical applications increased, the problems of the die caster have multiplied. The product designer's part of the job also has become more difficult. It is essential that the product designer and the die caster work together if the best possible results are to be obtained.

### Importance of Taper

The very best of die steels cannot stand up if the design necessitates weak sections in the mold, as for example a point or points at which heat may concentrate without having a chance to flow off properly, or where the full fury of the flowing metal may strike a small projection and wash the steel right out. The very best flowing alloy does not have much of a chance to fill deep recesses which cannot be reached by a good current of metal from the gate, or which cannot be vented properly. And the strongest of alloys have a tough time resisting the strain of shrinkage, particularly at points where heavy and thin sections are set together abruptly. While zinc has a "greasy" skin which does not have much of a tendency to stick to the steel of the mold, aluminum is "dry", has a very pronounced affinity for steel and tends to "solder" up. This difference in friction in the two metals expresses itself in the difference of the necessary taper. Taper is one of the points the designer is most likely to overlook, and yet practically no

die casting comes out of any mold without it. It pays to be liberal with it—.010 per inch of length on the diameter for zinc, for all others—aluminum, magnesium and brass—.015 per inch of length. These figures apply on inside faces, e.g., across holes and openings in the casting. On outside faces, which shrink away from the mold, tapers of .008 and .012 per inch of length, respectively, are good practice. The figures given can be reduced, especially in the case of zinc, but the reduction is paid for by a penalty imposed upon the die caster in bent or broken cores and ejector pins, or in scrap due to galled holes and scored side walls in the castings. In the final analysis it shows in the quality as well as in the price of the castings.

### Relation of Tapers and Tolerances

Another one of the "big little things" that should be considered from the very first by the product designer is the close relation of tapers and tolerances in the making of die castings. It is difficult to formulate a general rule concerning tolerances. However, keeping in mind that a die casting is primarily a casting, or a semi-finished product, the following standard represents good practice: for zinc—dimensions under one inch, plus or minus .002, and add plus or minus .001 for each additional inch of length up to eight inches; for aluminum and magnesium—plus or minus .003 up to one inch, and add plus or minus .001 for each additional inch of length up to six inches; for brass—plus or minus .004 up to one inch, and add plus or minus .001 for each additional inch up to five inches. These tolerances may be applied provided the dimension is not affected by any movable die parts as slides, cores, or the parting line of the die halves where greater limits are required. As with the taper rule, variations and reductions of tolerances are possible, but at a cost.

Again, cast zinc alloy offers the best possibilities for holding close dimensions. This is not surprising when we consider the circumstances. Zinc alloy is cast at temperatures which range from 760 degrees F to 820 degrees F while aluminum

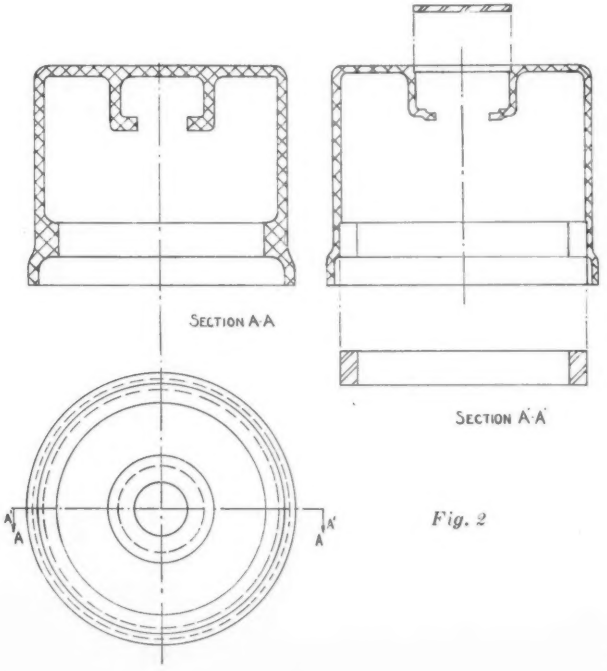



*Fig. 2*

and magnesium are cast at from 1200 degrees to 1300 degrees F, and brass even higher than that—up to 1800 degrees F. By adding finish machining operations, however, zinc runs, on very extreme limits, a close second to the other die casting materials due to the primary and secondary dimensional aging changes. The primary aging, which takes place in the first six weeks after the casting is made, can be overcome by heating the casting to 212 degrees F for six hours. The secondary changes would have to be considered in the most extreme cases only. For most practical purposes, even the primary aging change is negligible.

### "Good Compromises Are Usually the Best Solutions"

All of the ideas expressed so far should enter into the considerations at the very beginning of the design, and fortunate are the product designer and die caster, who in close cooperation, are able to create a product which has incorporated the experiences of both. There will always be compromises, but good compromises are usually the best solutions for technical problems. The tendency to develop the design of a product from the definite viewpoint of its manufacture by specialized production methods is firmly established. The illustration Fig. 1, for the Head Massager produced by Black & Decker Company, Kent, Ohio, is a fine example. No other method could have produced the complicated shapes and at the same time given the mechanical qualities necessary for the support and operation of the mechanism. So the designer developed his parts, not only as parts of a whole, but as die castings also, and the result is an attractive product that can be produced efficiently with a minimum of expensive machining operations.

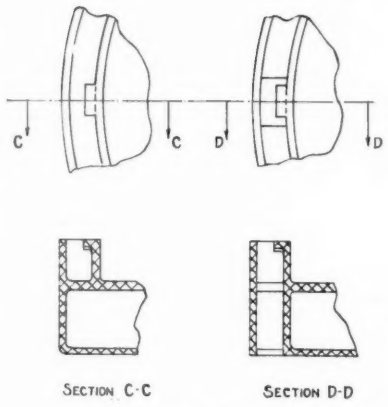



*Fig. 4*

The illustrations, Figs. 2, 3 and 4, give some ideas of what can, or has to be done, in redesigning a part for die casting. While the same considerations regarding metal to be used, taper and tolerances and so on, enter into the design of a new part or product, other designing problems come up which have their sources in the different capabilities of several possible production methods.

Fig. 2 shows a housing which originally was designed for sand casting, section A-A, with finish machining. It contains two undercuts which did not represent any difficulties for the sand caster. In order to die cast this part, however, several radical changes had to be made. Note section $A_1$-$A_1$. In order to save material, the wall stock was reduced. The heavy ring was cast as a separate casting, and the top opened up in order to core the inside chamfer. While the sand casting had to be ma-

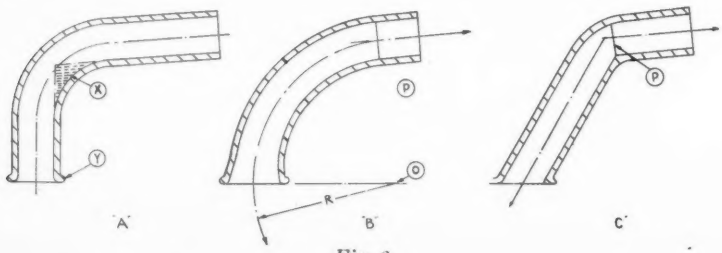



*Fig. 3*

chined all over inside and outside, the only operations necessary, besides trimming the die casting, were pressing the ring in place and closing the top by spinning the plate in place.

Fig. 3, "A", "B", and "C" are sections along the center of suction nozzles as used on vacuum cleaners. "A" is a sand casting, and the shape does not allow coring the inside at point "X". The bead at point "Y" is rounded. "B" shows an alteration which allows cores to be pulled, as indicated by the arrows, one core straight and the other as a circular core around the center "O". The bead is still round, making it necessary to match the impression on the highest point of the bead, as the die will be split at that point in order to machine the shape of the nozzle in the die. The parting line of the die is represented by the surface of the drawing. This is perfectly sound die casting. But going one step further to "C", we find the cheapest solution—as far as the die is concerned—by using two straight core-pulls as indicated by arrows. The parting lines between the two cores in both "B" and "C" are marked "P". The bead also has been changed to avoid matching the impression in the die blocks. The casting shows a variation of section. The inside bent has been squared out by increasing the wall thickness to allow the two cores to match and to avoid an undercut. The narrowing down of the opening might be objectionable from the point of view of the product designer, but if the opening is sufficiently large to allow the necessary flow of air, he is in a position to save several hundred dollars in the initial cost of the die, reduce die maintenance cost and likely get the casting at a lower unit cost.

### Avoid Loose Pieces if Possible

Fig. 4 shows the lug of a bayonet connection. Space available did not allow the use of a loose piece in the die in order to cast the undercut under the lug. Loose pieces can be used, but they are one of the last expedients the die caster turns to, as they slow down the rate of production and usually add extra cleaning ex-

*(Continued on Page 28)*

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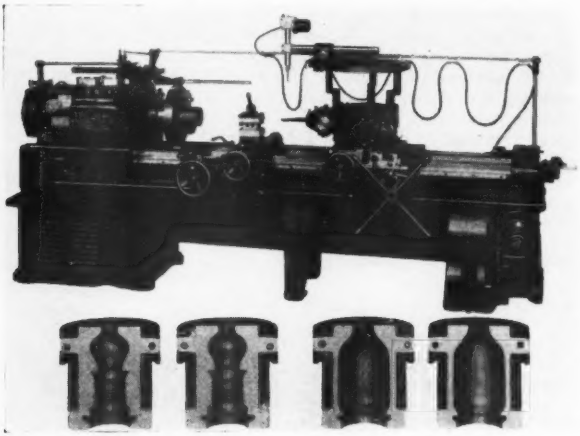
# Duplicator Control Increases Contour Boring Production

THE use of a standard duplicating attachment in the plant of a leading bottle manufacturer to provide automatic control of contour boring in the production of cast iron molds has given three advantages: absolute symmetry of mold halves; an increase in production; and a marked reduction in polishing time. The molds are for glass bottles and the contour boring is done on a standard turret lathe.

In order to assure close conformity of the work with the template, a solenoid actuated clutch, operating from the tracer head, and mounted on the cross slide feed, provides an exceptionally fine control for the feed of the cutting bar.

An example of the control possible with the solenoid clutch is shown at the left in the illustration. This mold was run to prove the accuracy of the set-up before acceptance by the purchaser. The



*Detroit Universal Duplicator mounted on an Acme Turret Lathe for production of glass bottle molds. The right pair of molds illustrates a a typical production job; the intricate shape of left pair was used to test duplicating control accuracy. Photos of molds are unretouched.*

The control mechanism, manufactured by Detroit Universal Duplicator Company actuates the cross slide of the turret of a standard Acme Turret Lathe to move the boring bar in conformity with a metal outline template which conforms to the shape of the finished mold. This is accomplished with such accuracy that in addition to the savings in actual production time, mold costs are further reduced through the savings in time required for polishing and burnishing.

The template for contour boring is mounted on the head of the lathe; the tracer head is mounted on the turret and the tracing finger follows the template and transmits a series of interrupted electric impulses to the control unit which, in turn, actuates the cross feed in exact conformity with the template. accuracy of control provided by the clutch permits stopping the operation at any time without gouging the work.

In operation, the two mold halves are clamped together in the lathe by means of a special chucking device. After facing one end, the operator moves the turret mounted boring bar up to starting position and then starts the duplication control mechanism. When the internal cut is completed, the work is removed and reversed in the lathe to complete the mold by facing the opposite end.

**The control mechanism, Detroit Universal Duplicator, is manufactured by the Detroit Universal Duplicator Co. For full information, including an application you may have in mind, write to the Company at 215 St. Aubin St., Detroit, Mich.**

## DoAll Holds Fifth Convention

A TWO-DAY convention at the Des Plaines plant of the Continental Machines, Inc., builders of the DoAll Contour Machines, marking the fifth anniversary of the company, was attended by DoAll sales engineers from all parts of the country. In the plant particular attention was given the improved Continental Band Filer, the ultra-modern set-up for the production of narrow band saws and the Saw Testing Laboratory and Experimental Department. The conventioneers had their first look at the new DoAll Surface Grinder and the DoAll Tool and Cutter Grinder.

After the Des Plaines meetings, the men who had not previously visited the main manufacturing plant at Minneapolis, continued to the latter place via Zephyr and spent an additional two days in detailed examination of the main production plant, the grinder department and the tool room; the remainder of the time was spent in sales meetings and other activities that go with a successful convention.

## Offers Precision Instrument Service

THE Size Control Company of Chicago, Ill., offers an unusual service in precision measuring instruments that will interest many tool rooms and die shops, particularly those that have hesitated about purchasing much equipment because of their unfamiliarity with the relative merits of the available equipment. This company coordinates in one organization the best of the old and the new measuring instruments and is thus in a position to make the best recommendation for any manufacturer's inspection problem. Among the devices handled and regarding which the Size Control Company will furnish complete information and submit recommendations to fit requirements are: comparators, gage blocks, hardness testers, photo-electric equipment, dial micrometers, measuring wires, toolmakers' indicators and microscopes and testing equipment.

**An inquiry directed to the Size Control Company, 33 East Wacker Drive, Chicago, Ill. (phone Central 6592), on any inspection problem or type of precision measuring equipment will receive prompt attention.**

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Make every first cut "on the nose" by setting planer or shaper tools with this high accuracy Starrett No. 599 Shaper Gage. Handles many gaging operations not possible with an ordinary planer gage. Used with a micrometer or caliper, it will gage with accuracy within its range of ¼ to 6½ inches. Alignment and parallelism of ends, sides and work contacts held to close limits. Use of angular slide ways eliminates lateral play. Note handy level. For a complete description see Starrett Catalog No. 26-DM. Write for a copy.

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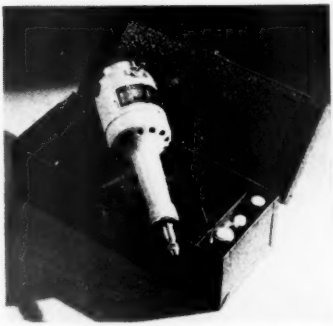
# Dumore No. 10 Hand Grinder Has Many Tool Room and Die Shop Applications

THE Dumore No. 10 Hand Grinder, "the finest development in off-hand grinding tools," is finding a steadily increasing number of tool and die shop applications because it has more than twice the power of average hand grinders, runs at a speed averaging a third greater and is sturdy enough, in spite of its light weight and non-tiring use, to hold up under the severest conditions.

Particularly useful for finishing small openings, radii and irregular shapes in all types of molds and dies, correcting inaccuracies in blanking dies, taps and cutters, sharpening dies, lapping small holes, the Dumore No. 10 Grinder is a tool that will be kept busy in even the smallest shop. Originally custom-built for a large automobile manufacturer, the No. 10 Grinder, like all Dumore equipment, is powered by the Dumore Precision Motor which is dynamically balanced, has pre-expanded armature windings sealed to prevent centrifugal "breathing", commutators ground concentric with bearings to assure longer brush life and armature leads swaged to commutator by special Dumore process. Only 9$\frac{13}{16}$" long and weighing but 2 lbs., 12 oz., the No. 10 has more than twice the power of the standard Dumore No. 8, the extra capacity greatly extending the number of applications that can be economically handled in the shop.

A new steel carrying case, with places for the standard equipment furnished with the No. 10 Grinder, is now available. This case may be purchased separately.

**A circular "Now You Try Dumore No. 10" or a copy of "Dumore Precision Grinders" catalog will be sent promptly on request. Address The Dumore Company, Dept. 370-J, Racine, Wis.**



## Points in Casting Design

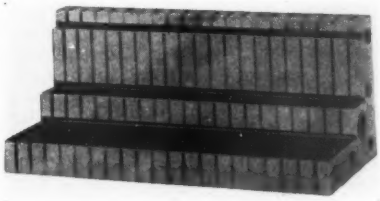
*(Continued from Page 23)*

pense to the casting. The up-keep of the die is high also as the loose pieces have to be replaced frequently. On high production jobs this frequently means that one man in the die shop is kept busy making loose pieces for such a job. The drawing is self-explanatory. Section C-C shows a design which could not be cast. Section D-D shows the solution, a core coming up from the bottom of the casting forming the under side of the bayonet lug and forming a new wall to shut the inside at the right off from the opening through the bottom wall necessary to reach up under the lug.

These are only a few suggestions and examples which come up again and again in the daily practice of the die caster. It is clear that the closest cooperation between the product designer and the die caster is necessary to achieve the best results in the design of parts and products to be die cast. The simplest and most direct way to work out die casting design and production problems is to consult with an experienced die caster.

## Geo. Scherr Co. Announces Universal MAGNE-BLOX Angle Iron

THE George Scherr Company announces the latest development in their line of MAGNE-BLOX products, the new universal MAGNE-BLOX Angle Iron, one of the most useful devices for the magnetic chuck designed for holding diversified work of all types.



The MAGNE-BLOX Angle Iron consists of a series of steps measuring in width $\frac{3}{16}$", $\frac{3}{8}$", $\frac{1}{2}$", $1\frac{5}{16}$", $1\frac{5}{8}$", upon which may be placed all manner of special pieces for surface grinding without the use of complicated clamps and attachments. Over-all dimensions are 3"x3"x7½". When placed on the plane surface of the magnetic chuck, the MAGNE-BLOX Angle Iron will actually form a magnetic right angle which gives the same holding power per square inch as the chuck itself.

Among its numerous uses the MAGNE-BLOX Angle Iron simplifies grinding straight edge sections without the use of clamps, eliminates setting-up time for grinding small pieces, may be used for grinding all four sides of a square. With the use of a sine-bar or a bevel protractor, work requiring grinding operations at various angles may be laid out and fastened to the side of the angle iron.

**Prices and other information will be sent promptly. Write the George Scherr Co., 128-B Lafayette St., New York, N. Y.**

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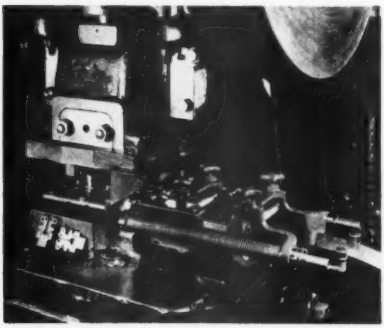
## Dickerman Introduces New Die Feed

THE H. E. Dickerman Mfg. Co., builders of the original Dickerman Hitch Feeds so widely used, announce a new Dickerman Die Feed, which embodies all the advantages of the original plus new features, to handle heavier materials and wider widths.



The new Die Feed is designed to handle coiled stock up to $\frac{3}{16}$" thick and any width up to 4". It can be installed on almost any type of punch press and can be placed on the die set in any position for any style die. The accurate feed control eliminates feed-trouble jams. The Die Feed and the required die set may be quickly set up on any idle press —this is particularly advantageous for short runs or rush work. The Die Feed, with the two main springs of oval wire, solidly built, semi-steel castings frame, adjustable stock guide rolls and twin operating cam for attaching to the punch holder is simple to operate and low in maintenance cost. Automatic operation, savings in materials, as well as labor cost and low initial cost, combine to make the Dickerman Die Feed a very profitable investment.

**An illustrated circular on the new Dickerman Die Feed will be sent on request. Write H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass. If more convenient call or write the Producto Machine Co., exclusive sales distributor, Bridgeport, Conn., or 3017 Medbury Ave., Detroit, Mich., Cleveland area, Die Supply Co., 1390 E. 30th St., Cleveland, O.**

## Lufkin Markets New Chrome Face Steel Tape

CHROME Face is the name of the line of Steel Measuring Tapes that has just been put on the market by The Lufkin Rule Company. These Tapes are entirely new and different than any others. Their markings are durable as well as easy to read. These two features are most important to every user of Tapes.

They are accurate Steel Tapes, chrome plated, with jet black markings and satin chrome-white surface, unusually free of glare. The permanent markings stand out in sharp contrast showing up well even in poor or artificial light. Being built up by chrome plating, these Tapes are extra strong and resist rust. The surface is smooth, hard and easy to clean and the tape, being of metal throughout, will not crack, chip or peel. New cases and frames of improved design and appearance have been built for this new line.

Chrome Face Tapes in cases are now offered in two brands: "Anchor" in $\frac{3}{8}$" and $\frac{1}{2}$" widths in genuine leather case; and "Leader", the popular priced line, $\frac{3}{8}$" wide, in durable and attractive imitation leather case.

While new on the market, Chrome Face Tapes are the result of long and careful study and experimentation and their durability as well as readability and other essential qualities have been thoroughly proven through many months of tests under actual, severe conditions of use.

**Ask the Lufkin man that calls on you or your dealer to show you Chrome Face Steel Tapes. Or, if you prefer, write The Lufkin Rule Co., Saginaw, Mich.**

## *Industry Marches On*

R. J. Wilkie, vice president of Continental Machines, Inc., the DoAll people, stated at the recent Fifth Anniversary Convention held for sales engineers that the Contour Machine production would be doubled within three months. The Grinder Department is moving to a new building of its own where the new DoAll grinders will be built.

---

The Dayton Rogers Mfg. Co. of Minneapolis, Minn., announces a new one-story factory building to house new machinery and other special equipment to be used in the manufacturing of metal stampings in small lots. D. A. Rogers, president of the company, states that the added floor space will practically double the present production capacity.

---

Frederick Colman & Sons, Inc., Detroit, manufacturer of tools, dies and special machinery for the automotive and aviation industries, will build a $150,000 addition to their plant.

---

The Smith Power Transmission Co. formally opened their new quarters at 1545 E. 23d St., Cleveland, O., Friday, Sept. 6th, with an open house. The new shop and office space is approximately double that previously occupied. This is the fourth expansion since the company began operations in 1924.


**CRALEY OFFSET BORING HEAD SETS**

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# DARWIN STEELS

**Stand for Quality**

We made the *first* HIGH CARBON-HIGH CHROME Steels which were also NON-DEFORMING, opening the way to

**Quantity Production**

with all kinds of Dies and Press Tools

Oil-Hardening
"NEOR"

Air-Hardening
"COBALTCROM-PRK"
—the latter also in CAST FORM

have become the standard on which all subsequent similar kinds of Steel were based.

We supply also
High Speed Steels
in Bars, Forgings, Tool-Bits
as well as all types of
**High Grade Tool Steels**

*Write for descriptive Circulars*

WELDING RODS
*Save time and money in die repair or tool redesigning as used in Precision-Welding.*

*Full particulars on request*

**DARWIN & MILNER, Inc.**

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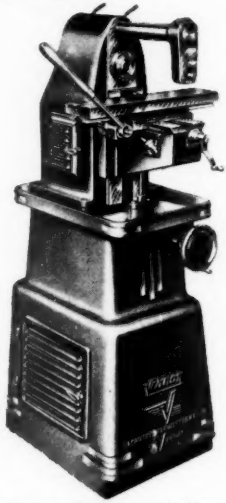
## New Hand Miller Added To Vernon Line

A NEW addition to the Vernon line of precision milling machines is the Vernon No. 0 Hand Miller for high speed milling of smaller parts. With hand lever operated rack and pinion feed, the Vernon No. 0 is a precision machine tool providing the accuracy and sturdiness required by tool rooms and die shops that are producing precision parts and accessories.



The fully enclosed variable drive operating in these speed ranges provides correct spindle speeds for every job. The ground spindle of heat treated steel is mounted on Timken tapered roller bearings. The taper in the spindle is No. 9 Brown and Sharpe. Two standard speed ranges are available: 100 to 1000 rpm, or 150 to 1500 rpm. Power is provided by a ½ hp 1750 rpm motor operating at 60 cycles. For continuous high speed operation a ¾ hp motor is recommended. The Vernon No. 0 Hand Miller is a versatile tool room machine designed to do the ordinary jobs required of a milling machine as well as the steadily increasing number of semi-production armament program jobs.

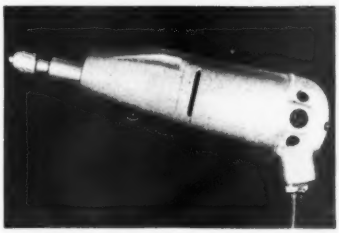
**Literature on the new Vernon No. 0 Hand Miller is available from the Machinery Manufacturing Co., P. O. Box 155, Vernon Br., Los Angeles, Calif.**



When you order or write about products described in TDM PROGRESS please mention the publication.

## Reciprocating Action Hand Tool Has Power Stepped Up

THE H & H Research Co., announces the new series "C" Reciprocating Action Multi-Purpose Tool, with more than three times the power of models previously developed by this company.



With a stroke length of ⅜" the Series "C" tool develops a 30 to 40 pound pull or push at the end of the chuck and may be used to file, burr, hone, snag, polish, saw and chip. The previous "A" and "B" tools developed pulls of 6 to 8 and 8 to 12 pounds respectively. Series "C" Reciprocating Action Tool can readily be adapted as a vertical or horizontal filing machine.

Series "C" "Multi-Purpose" tool is powered by a 1/30 hp R & M series wound universal motor, specially designed for this type of service. The tool is 10" long and 2¾" in diameter; the chuck has a capacity of ¼" round or square (with adaptor ⅛" round); gear ratio of 4-1 with gears and bearings of hardened bronze and all working parts of hardened and polished steel finished to close limits.

**A circular on the Series "C" Reciprocating Action Multi-Purpose Tool includes data on files, hones and other accessories available. Write H & H Research Co., 1925 W. Buena Vista, Detroit, Mich.**

## Taft-Peirce President a Faithful Reader

A "hair's breadth" dimension incorrectly designated in our August issue brought a prompt correction from Frederick S. Blackall, Jr., president and treasurer of Taft-Peirce Mfg. Co. He writes... "diameter of your hair, unless most unusual... is about .002"" and that "when a tool maker works to half a 'tenth' he is splitting a hair into about forty parts."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## No. 3 Contour Grinders

**for rapid, economical, accurate grinding and polishing of contours or irregular shapes.**

TOOL ROOMS AND DIE SHOPS WILL RECOGNIZE THESE NUMEROUS ADVANTAGES:

Convenient working height, complete visibility.

Vertical spindle mounted on large precision anti-friction bearings. Three speeds from Vee Belt drive.

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**BAKER BROS., INC.**

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## New Data on Kennametal

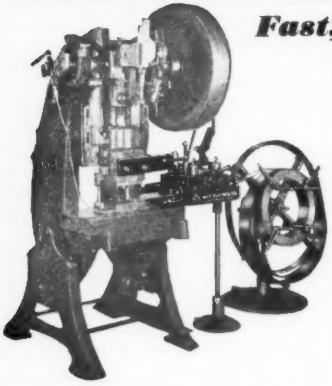
McKENNA Metals Co., Latrobe, Pa., state that a new six-page folder, Bulletin 740, "Cut Steel Profitably with Kennametal Tools and Blanks," which contains complete factual data on this new hard carbide tool material, is ready for distribution. The folder describes how Kennametal is manufactured, where it can be used and why it is said to be the best tool material for machining steel of all hardnesses up to 550 Brinell.

Three tables describe (1) the comparative physical properties of Kennametal, (2) materials machined with Kennametal and (3) recommended speeds for machining steels of various hardnesses. A chart demonstrates the increased cutting speeds and greater hardness range of steels machined with Kennametal, as compared to cobalt chrome alloys and high speed steel. Illustrations show typical turning, milling and shaping operations employing Kennametal-tipped tools.

**Copies of Bulletin 740, "Cut Steel Profitably with Kennametal Tools and Blanks," will be sent to those requesting it on their company letterhead. Write McKenna Metals Co., 500 Lloyd Ave., Latrobe, Pa.**


# WITTEK ROLL FEEDS

FOR ANY MAKE AND SIZE OF PUNCH PRESS



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**Wittek Roll Feeds** can be installed on **any** make or size punch press without alterations, will handle **any** type coiled stock and will feed in **any** of four directions—right to left, left to right, back to front or front to back in any length from 0" to 24" per press stroke at catalog speed or faster.

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**4305 W. 24th Pl. Chicago, U.S.A.**

**WITTEK ADJUSTABLE Reel Stands**

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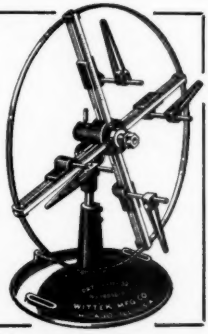

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● This directory of products lists for ready reference the names of manufacturers and dealers whose sales to Tool·Die·Machine PROGRESS readers have established them as dependable in every sense of the word. They merit your consideration.

● Complete information about any product may be had upon request made to the firm listed or to us.

● Your mention of Tool·Die·Machine PROGRESS will be appreciated.

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**CASTINGS— Nitri-Cast-Iron**
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Danly Machine Specialties, Inc., 2121 S. 52nd St., Chicago, Ill.
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.
Knu-Vise, Incorporated, 16841 Hamilton Ave., Highland Park, Michigan.
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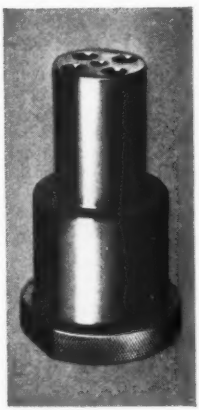
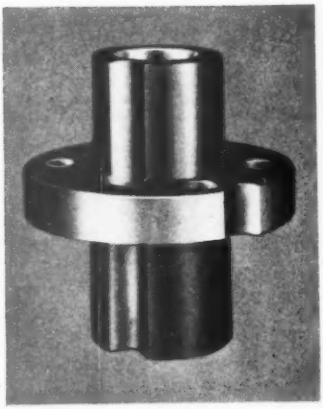


WE CAN MAKE THEM FANCY, TOO!



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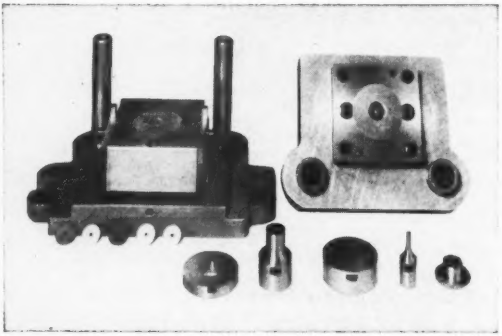

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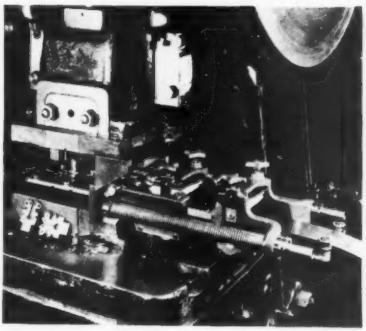

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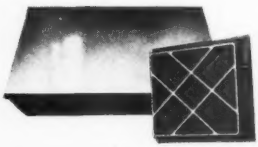
Here is a surface plate that has every feature you want for good layout work. Massive design and heavy ribbing to prevent warping. Surface precision ground to close limits. All edges machined square with each other and with the face. Wide ledges all around for clamping work, angle plates, vises, etc., impossible to do with improvised plates.



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*STYLE A*, plain boring tools, particularly efficient on lathes, are guaranteed to give consistent performance. Shanks never require renewing.

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Davis Tool & Engineering Co., 6481 Epworth Blvd., Detroit, Mich.
Denning Mfg. Co., The, 1775-81 E. 87th St., Cleveland, Ohio.
Detroit Stamping Co., 344 Midland Ave., Detroit, Mich.
Federal Tool Corp., 412 N Leavitt St., Chicago, Ill.
Knu-Vise, Incorporated, 16841 Hamilton Ave., Highland Park, Michigan.
Modern Tool & Die Co., P. O. Box 2741, Cleveland, Ohio.
Star Machine & Tool Co., 9320 Woodland Ave., Cleveland, Ohio.
Star Tool & Die Works, 2522 24th St., Detroit, Mich.
Variety Machine & Stamping Co., The, 12695 Elmwood Ave., Cleveland, Ohio.

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Wheelock-Lovejoy & Co., Inc., 130 Sidney St., Cambridge, Mass.

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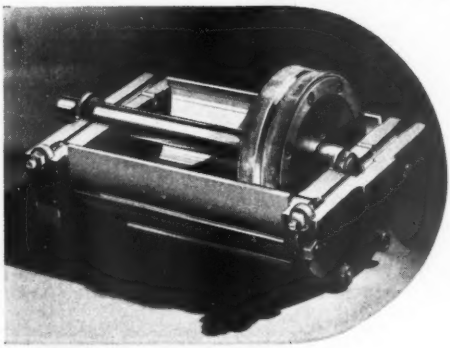

**T-J CUSHIONED AIR CYLINDER**

Complete specifications of Cushioned and Non-Cushioned types are shown in our Catalog 36-A. Your copy will be sent promptly. Address The Tomkins-Johnson Co., 630 N. Mechanic Street Jackson, Mich.

**The action of the cushioned part of an air cylinder stroke depends on variables that are, at best, difficult to determine. This condition can be offset in part by having this cushion action adjustable. Cushion adjusting screws operate to "slow" or increase the speed of the cushion action.**

***Furnished as standard equipment on T-J Cushioned Air Cylinders,* these screws may be readily *adjusted and locked in position on the job***

*this is a* **TOMKINS-JOHNSON** *product*




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Sal-way Steel Treating Inc., 624 W. Elizabeth St., Detroit, Mich.

**SURFACE PLATE**
Delta Mfg. Co., 632 E. Vienna Ave., Milwaukee, Wis.

**TAP EXTRACTOR**
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**TAPPER—Precision**
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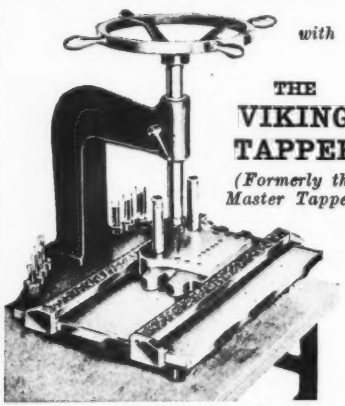

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Capacity ¼" to ⅞"

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Enough spacers for average use on one machine, sent for $1.00. Give arbor size when ordering.

*Price list No. 70 sent free*

**DETROIT STAMPING CO.**
344 Midland Ave. Detroit, Mich.




When you order or write about products described in TDM PROGRESS please mention the publication.

## Stripper-Plate Mold Design

*(Continued from Page 17)*

bolts make additional parts which may work loose in the closed ejector box and cause damage.

A hole is provided opposite the sprue for the cold slug. This is a straight hole and the sprue ejector pin is under cut to pull the sprue slug. Water lines are incorporated in the stripper-plate with the same layout and spacing as in the cavity retainer plate. The plate is ground flat and is relieved to match the relief on the cavity retainer. This relief is not usually shown on the assembly drawing but should be specified on the detail drawing.

### Ejector Mechanism

The ejector mechanism consists of stripper-plate ejector pins, sprue lock pin, ejector return pins, pin retainer plate, pin assembly plate, ejector box and ejector rod.

The pins are made of drill rod upset at the retaining end. In this mold four stripper ejector pins (detail 5) are used. They are cut back a distance equal to the depth of the cold slug so that the sprue lock pin (detail 27) will push the slug out before the stripper-plate moves forward. Ejector return pins (detail 24) run through the stripper-plate to push the assembly back as the mold closes.

The pins are held in the retainer plate (detail 16) which is screwed to the assembly plate (detail 25). The assembly moves back and forth in the ejector box. The outline of which is shown at detail 22. The ejector rod (detail 14) is upset or turned for retention in the ejector box. The pin assembly plate is counterbored to make room for the head of the ejector rod. The ejector box is formed by four spacers (detail 4) screwed to the adaptor plate (detail 2) by the screws (detail 3).

### Sprue, Runners, and Gates

The material is introduced into the mold through the sprue. The tapered hole in the sprue bushing is shown at detail 21. From the sprue it flows through the runners (detail 23) and the gates into the cavities. The sprue bushing shown is of alloy mold steel, hardened, and has a spherical seat which is lapped to fit the injection nozzle.

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## Jessop Steel Releases Literature on Truform Alloy Tool Steel

A NEW six-page folder describing "Truform", a non-shrinkable, oil hardening alloy steel for use in tools and dies where extreme accuracy is required, has just been issued by the Jessop Steel Co., Washington, Pa. The present acute shortage of skilled tool and die workers makes Truform particularly useful since it can be used to advantage by less experienced men due to its high resistance to distortion.

The new folder fully describes the physical properties of Truform, which include a low coefficient of expansion, greater hardness, exceptional toughness and good machinability. Also described are the recommended heat treatment and typical applications. A chart illustrates the tempering range for Truform.

**Copies of the new Truform folder are available on request. Write Jessop Steel Co., 612 Green St., Washington, Pa.**

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**We maintain an unusually large stock of Dowel Pins—including many sizes not ordinarily carried.**

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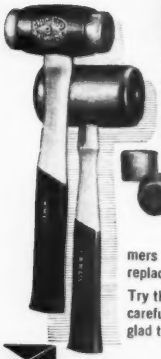
### Norton Metal Bonded Diamond Wheels

THE Norton Company announces a new publication, "Norton Metal Bonded Diamond Wheels" (Form 388-P), which the Company designates as their first booklet to thoroughly discuss the uses and application of the Norton metal bonded diamond wheel. The subtitle, "A Handbook on reconditioning and sharpening single point Cemented Carbide tools rapidly and economically," gives the specific scope of the booklet. Following the Norton handbook plan, the booklet is thorough, practical, well illustrated and well indexed. Every user of metal bonded diamond wheels will find this booklet very useful.

**For a copy of "Norton Metal Bonded Diamond Wheels" (Form 388-P), write the Norton Company, Worcester, Mass.**


**NOTHING BETTER** *for careful work . . .*



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Try them for all shop work which must be carefully done. Your supply house will be glad to demonstrate.

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### Peerless Metal Cutting Saw Catalog

PEERLESS Machine Co., Racine, Wis., have their new Catalog Number 51-P describing and illustrating the full line of Peerless Universal Metal Cutting Saws ready for trade distribution.

Special, phantom drawings illustrate the design and functioning of the exclusive, patented, Four-Sided Saw Frame. This construction incorporates a Backing-Plate Blade-Support for supporting the hack saw blade which is tensioned in the center of the frame instead of at the bottom.

The value of these features, for extremely heavy metal cutting, is shown and substantiated by tables of cutting speeds. Full specifications of the three standard models are given.

**Write for your copy of Catalog No. 51-P to Peerless Machine Co., Racine, Wis.**

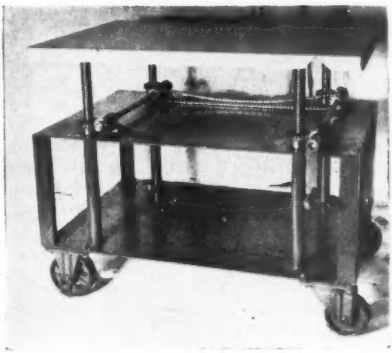


**When you order or write about products described in TDM PROGRESS please mention the publication.**

## Johnson Adds Flat Top Die Trucks to "Multiduty" Line

THE O. Johnson Mfg. Co., Cicero, Ill., has added two Flat Top Die Trucks (also called Feeder Trucks) to their line of "Multiduty" Die Trucks and Portable Work Benches. Of sturdy, rigid electric-welded construction, the new Die Trucks, are designed for long and useful service.

The simplicity and ease of operation make them valuable in the tool room and die or mold shop, particularly for transferring, transporting, supporting, etc. These Flat Top Die Trucks effect a decided labor saving in the handling and transporting of dies between operations. They also improve the safety factor for both men and dies.



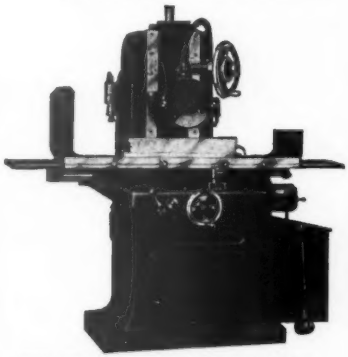
The new "Multiduty" Flat Top Die Trucks are made in two sizes, style F-1, with table 28" x 40", capacity 3000 pounds, and style F-2, with table 24" x 40", capacity 2000 pounds. Both sizes operate from a minimum table height of 24" to a maximum of 40".

**A circular describing the new line of "Multiduty" Flat Top Die Trucks is ready for the trade. Write O. Johnson Mfg. Co., Dept. Q, 6027 W. Roosevelt Road, Cicero, Ill.**

### CORRECTION

Atlantic India Rubber Works, Inc., states their new Catalog is designated 21P, not T21 as listed on page 33 of the August issue. The correct number is given in the footnote on the same page and also in their ad on page 47 (also page 50 of this issue).

*Speed* and
Precision *Combined*



IN GRAND RAPIDS HYDRAULIC FEED SURFACE GRINDERS DESCRIBED IN
*BULLETIN GL 100*
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REMOVE BROKEN TAPS

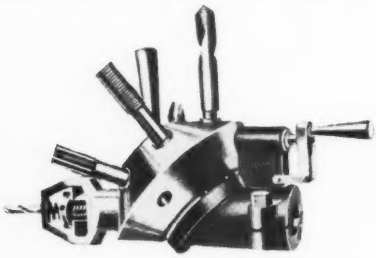
*Quickly--*
Insert WALTON Tap Extractor and back out broken piece. No annealing—no drilling.
*Easily--*
Tap Extractor and Tap Wrench are only tools needed.
*Safely--*
Threads are not damaged. Not necessary to tap oversize after broken tap is removed.
*Folder 131 gives complete details*
THE WALTON CO.
88 Allyn Street Hartford, Conn.



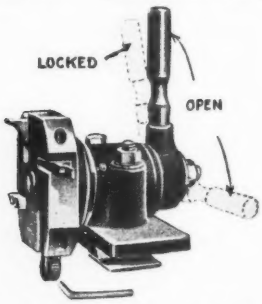
When you order or write about products described in TDM PROGRESS please mention the publication.

## Jefferson Offers New Tools for Increasing Tool Room Production

THE Jefferson Machine Tool Co., Cincinnati, O., has just announced two new tools—a Tail-Stock Turret and a Tool-Post Turret—designed to increase production on tool room lathes. The Tail-Stock Turret is a rotary turret head



accommodating five tools that can be attached easily in a few seconds with an ordinary wrench to the spindle of the Tail-Stock on any lathe. The attachment illustrated fully tooled, is perfectly rigid and sturdy enough to withstand the same strain as the tail stock. Once set, each tool centers automatically when




brought into play. The Tail-Stock permits of forming, roughing, boring, drilling, tapping, finishing and etc., without stopping the lathe or shifting belts when operations are changed. The Tail-Stock Turret is available in three sizes.

The Jefferson Tool-Post Turret, as shown, permits four tools to be brought into instant action. Quickly mounted on the tool post of a lathe of any size or style, this attachment is as rigid as the standard tool post on the lathes. The tools may be switched quickly, without shutting off the power. All parts are carefully machined and case hardened. The openings for the tools measure ⅝" x 1¼" x ½" deep. The head may be adjusted to any desired angle by loosening the rear screw at top of head.

**An illustrated circular giving specifications and prices of the Tail-Stock and Tool-Post Turrets is available. Write Jefferson Machine Tool Co., Fourth and Sweeney Sts., Cincinnati, O.**

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WOVEN RUBBER MATTING

*Reduces Damage and Breakage*
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Stock sizes or Custom made.

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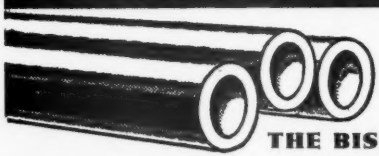

Substantially reduces labor costs by eliminating the expensive procedure of drilling from the solid.
BISCO TOOL STEEL TUBING is a fine grade tool steel in tubular form available in sizes up to 14" diameter and 2" wall thickness; other sizes to your specification.
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## New Automotive Gear-Shift Eliminates Belt Shifting

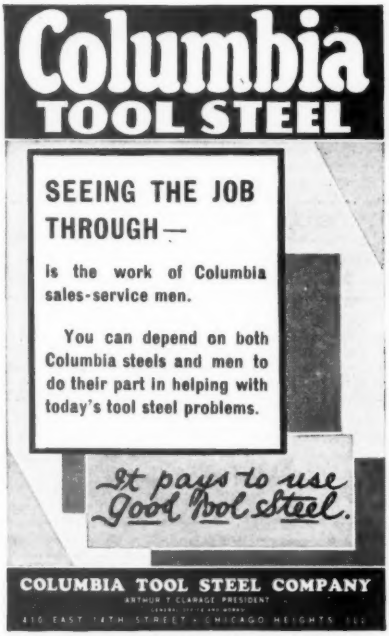
A NEW automotive gear-shift which provides for instant interchangeability in speed without shifting any belt is offered by the Lima Electric Motor Company, a subsidiary of the Lima Armature Works, Inc., Lima, Ohio.

The gear-shift is built to give three speeds forward and one reverse, or four speeds forward (and in reverse with the aid of a reversing switch). It is built as an integral part of the motor and also as a gear-shift drive which can be used with any standard motor. A lathe bracket for use with the latter unit is also made.

Because of its instant speed changeability, the new gear-shift is finding quick acceptance for use on lathes, milling machines, drill presses, grinders and other tool room machines. The complete motor and gear-shift mechanism is installed to eliminate counter-shafts. The gear-shift drive alone is normally installed on machines which are already driven by individual motors. By eliminating belt shifting to change speeds, the makers state that "dead" time is reduced, production increased and safety improved. These units are sold through direct factory representatives.

**For complete information on the new Lima automotive gear-shift, write Lima Electric Motor Co., 432 N. Main St., Lima, O.**

**Buying? Consult the "Buy with Confidence" Directory, Pages 35-40**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SEEING THE JOB THROUGH—
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It pays to use Good Tool Steel.
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## Swivel Head Bench Type Milling Machine Announced

THE Univertical High Speed Milling Machine, a swivel head bench type mill, is announced by J. D. Duffy & Son, Detroit, Mich., national and international distributors. The Univertical Milling Machine is said to be capable of doing all small jobs or about 90 percent of the work that can be normally done by machines costing several times as much. The machine is capable of the most exacting precision work—milling, drilling and boring. Univertical mills an 8" x 16" die at one setting and is designed for use of cutting tools up to ⅝". It can also be adapted to small grinding operations.

A bench type machine with a base 11" x 17", it has a four-speed V belt pulley, the range of speeds from 850 to 3400 rpm handling a wide range of intricate milling. The swivel head spindle swings and is graduated to a range of 90° either side of perpendicular. Its overall height is 37". The table, 24" x 4⅞", with T-slots, has a longitudinal travel of 17" and cross travel of 7", all

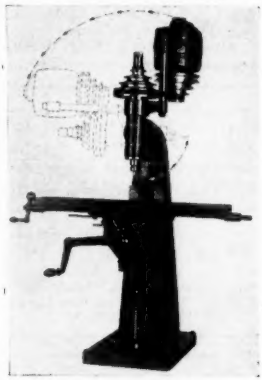

table movements graduated to .001". The maximum lift of the table to end of the spindle is 10" with a work clearance of 6½" from center of spindle to supporting column. The spindle, set in end and side thrust bearings, has take-up adjustments on gibs and collars. It is equipped with a ½" Weldon Tool Holder, accommodating tools from ¼" to ⅝" in diameter.

**For further information, including the extremely low price, write J. D. Duffy & Son, 544 Insurance Exchange Bldg., Detroit, Mich.**

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### Industry Plant Expansions

Hydraulic Press Mfg. Co. of Mount Gilead, O., is erecting a new 400-ft. building to add additional manufacturing facilities for their injection molding machines and hydraulic presses.

* * *

Charles J. Koebel, president of Koebel Diamond Tool Co., announces their removal to a new factory on Detroit's "avenue of modern industrial plants," at Grinnell Avenue fronting on the City Airport. The Koebel Company, established in 1931, has specialized in the manufacture of diamond tools for modern industrial use.

* * *

Included in the expansion program of the Westinghouse Electric and Manufacturing Co. at East Pittsburgh, Pa., is a new metal stamping building which will cost approximately $500,000.



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## Meehanite Institute Issues New Edition of Bulletin No. 9

MEEHANITE Research Institute of America, Inc., announces a new edition of Bulletin No. 9—"Meehanite, the Metal for Machine Tool Castings." A previous edition of this booklet has been re-edited and descriptions of a variety of additional applications of Meehanite castings in the machine tool industry are illustrated and described. A table and several charts of engineering properties of Meehanite and a list of licensed companies are included.

**Copies of new Bulletin No. 9, "Meehanite, the Metal for Machine Tool Castings," will be sent on request. Write Meehanite Research Institute of America, Inc., 311 Ross St., Pittsburgh, Pa.**

## Warner & Swasey Expands

THE third expansion of the Warner & Swasey Co. plant in four months is under way. Two buildings, one 100 by 300 feet, the other 100 by 100 feet, one and two stories and basement, of steel frame and with concrete floors and brick and glass block walls, will be rushed to completion. Also included in the expansion is a 21,000 square foot loading platform and alterations to the top floor of the old main building to provide more office space.


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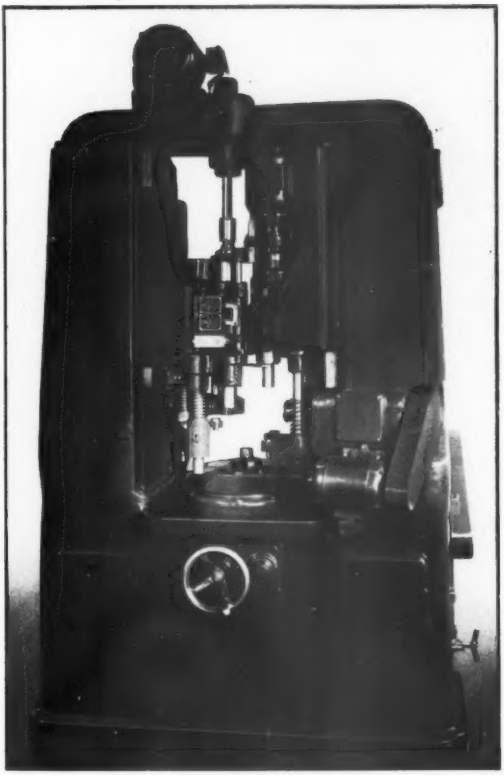

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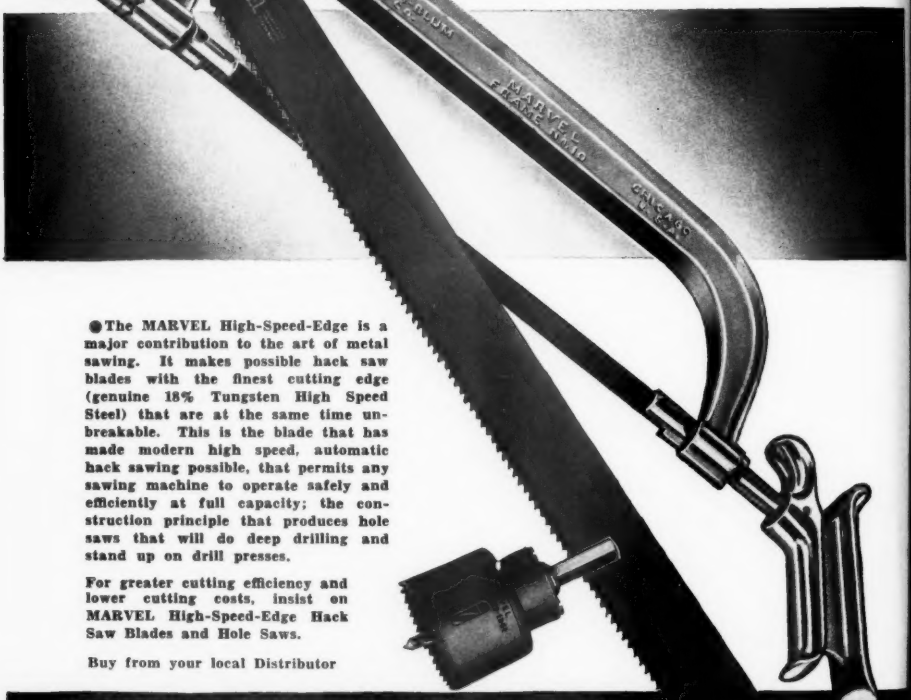


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